

THE MODEL ENGINEER

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The MODEL ENGINEER

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24 JULY 1947



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SMOKE RINGS

Our Cover Picture

THIS week we reproduce a photograph of a very fine model of the full-rigged ship *Brynhilda*, made by Dr. Stephen Rowland, of Northampton. Dr. Rowland served at sea in his younger days and obtained his master's ticket. Later he adopted the medical profession, obtaining the degrees M.D. (Edin.), and Ph.D. and was for years public health officer for Northampton. He is probably the only man in the country who has the highest qualifications in both the seafaring and medical professions. However, he has never lost his love of ships. *Brynhilda*, the prototype of the model, was well known as a crack sailing ship in the 1890's. The few sailing ships still surviving are very rarely seen with fresh paint-work and the yards properly squared, but in the '90's it was the ship-master's, and indeed the entire crew's ambition to bring their ship into port glistening with fresh paint and the yards squared to a hair's breadth. Dr. Rowland has caught this spirit very effectively in his latest model. In 1937 his model of the four-mast barque *Glaucus* was awarded the Championship Cup for the best sailing ship model at THE MODEL ENGINEER Exhibition. We are hoping to see the original of our cover picture at this year's Exhibition. The beautiful sheer line of the hull, and its nicely proportioned figurehead are clearly shown in the photograph, but unfortunately some of the intricate detail of the rigging may be lost in the reproduction. However, we hope readers visiting the Exhibition will have the opportunity of examining the model for themselves.

Exhibition Posters

A VERY fine poster has been prepared for the "M.E." Exhibition and we shall be pleased to send one or more copies to any reader who will kindly undertake to display them in suitable effective positions. For those who cannot give space to the large poster, a small bill is available which would be very appropriate for works and office notice boards, and shop windows. Copies may be obtained on application to the Exhibition Manager, 23, Great Queen Street, London, W.C.2. Please state which of the two sizes is required, or if use can be made of both of them.

Looking Ahead

I AM very pleased to say that the Smoke Ring, "Looking Ahead" which appeared on May 22nd, inviting contributions upon the subject of reaction engines and gas turbines has borne fruit. Today, on page 88, appears "The Internal Combustion Turbine" by A. H. Poole, A.M.I.Mar.E., the first of a number of articles dealing with this subject. This will be followed by another dealing with the Aerodynamic Turbine and a series of articles on jet propulsion. From America we hear news of a miniature reaction engine operating on the pulse jet cycle, as employed in the German V.1 engines fitted to their buzz-bombs. This engine weighs 16 oz. and develops a static thrust of 3½ lb. without ram air. It is fuelled by petrol and uses a sparking-plug for ignition purposes. Whether this sparking-plug is necessary for starting only, or whether it continues to function whilst the engine operates

is not clear. I cannot believe that model engineers in this country have allowed our American cousins to steal a march on us in this field of development and I am hoping to hear that among our readers, there are some who have something up their sleeves which will keep us in the running.

Model Yachting at Tynemouth

A LETTER from Mr. S. H. Walker, hon. secretary and treasurer of the Tynemouth Model Yacht Club, states that the local Corporation has drained and "de-mudded" the lake during the past winter; and that the club is waiting for the elements to complete the job by refilling the lake. It all depends upon the amount of water available whether the planned programme of competitions can be carried out. It is a very full programme, lasting well into October, so I am hoping that the elements will be kind enough to see that the lake is suitably filled.

The Pleasures of Model Engineering

THE pleasures afforded by the practice of model engineering are many and varied. One might ask a dozen enthusiasts in what direction the particular enjoyment they derived from the hobby was made manifest, and one might receive a dozen different answers. I put this question recently to a well-known friend of all model engineers, Mr. F. W. Bontor, and his reply, I am glad to say, coincided with the opinion I have often heard expressed by other enthusiasts. He said "Why shouldn't those of us who have the equipment and the spare time use some of these advantages for giving pleasure and perhaps practical help to those who are less fortunately placed?" Asked to be a little more specific, he said, "Come over to my house and I will show you something." I accepted the invitation and saw a truly remarkable example of precision handicraft which Mr. Bontor and his workshop colleague, Mr. R. Marshall, had recently completed. It was a completely rebuilt gramophone disc recording machine modified for cutting the extra fine line long-playing records used in the "Talking Book" library which loans these discs upon which books, novels, etc., have been recorded, to any blinded person, possessing the necessary playing desk, for their entertainment and recreation. The machine has been very kindly given to the "Talking Book" recording department to replace one lost when their Recording Studios were destroyed during a blitz. It had had a lot of use, and its line per inch cutting range was not suitable, so Mr. Bontor was asked if he could adapt it to cut 100, 150 and 200 lines per inch instead of the 84, 96 and 120 lines per inch for which it was then set and to tone it up a bit; he agreed to do what he could. The machine was duly delivered and taken all to pieces, each part was checked, in some the wear was very marked; to make a really satisfactory job, it needed entirely rebuilding. Mr. Bontor therefore offered not only to do this but exactly to copy the special machine that had been built for the "Talking Book" before the war by the same German makers; this meant adding a

number of fittings and attachments, so that a twin machine resulted. This offer was gladly accepted by the Recording Engineer, as it would enable records to be cut without his having to worry over controls, as he would have had to had there been any difference one machine to the other. Work was duly started and the problems involved attacked. The main part is something like a lathe bed with one slide on it; this was ground all over and the slide hand fitted, then each additional part was very carefully copied from the one they were using in the "Talking Book" studio and duly added. All parts that could be used were cleaned and replaced and polished where necessary. New gear trains were made to give the required ratios. As the machine had to work in a studio controlled at 70° F., fitting was therefore done at this temperature, the base plinth was repainted, and when finally assembled it became a piece of precision mechanism of the highest order.

A Gala Week at Slough

THE Slough Society is organising an attractive display of model engineering in all its branches to be held on Agar's Plough, in Eton College Grounds, from August 2nd to the 9th. Cups and other prizes are offered for engineering and aircraft models, and an interesting section of an up-to-date character will be devoted to electronics. A passenger railway track will be in operation. The show is in connection with the local Carnival Week, and given fine weather, a big success is assured. Competition entry forms, and other information may be obtained from the Exhibition Hon. Secretary, c/o Superflexit Ltd., Slough Trading Estate, or from the Slough Public Library, or Messrs. Aspro Ltd.

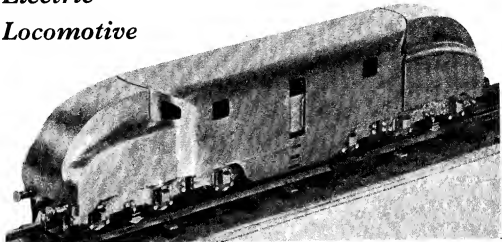
An Oxford Journal

IT is not every model society which can enjoy the luxury of its own journal, printed in true professional style. The Oxford Society has achieved this distinction, and their summer number is on my desk. It is a 20-page issue containing not only the usual news of Society doings, but some interesting general articles and practical workshop hints. "A Model Engineer in Australia" makes very interesting reading, and locomotive enthusiasts will enjoy the experiences of an apprentice in the Horwich works of the L. & Y. Railway. The President, Mr. J. H. Brooks, contributes a thoughtful article on craftsmanship in which he introduces some apt quotations on the virtues of a real job of work. One from Thomas Carlyle runs:—"The only happiness a brave man ever troubled himself with asking much about was happiness enough to get his work done. It is, after all, the one unhappiness of man that he cannot work; that he cannot get his destiny as a man fulfilled." How true this is of model engineers, how great is the satisfaction of executing and completing a piece of true creative work. Meanwhile, my compliments to Oxford on their nice little journal.

Perennial Hammy

An "O" Gauge Electric Locomotive

by R. B. T. Hall-Craggs



THIS model is a free-lance "O" gauge "Stainless Streamliner" electric locomotive. The cab and end bonnets are of 26-gauge stainless steel, each in one piece. Also of stainless steel are the valances under the cab, the buffer-beams and fittings and bolts whose heads are normally visible, while the wheels are of Audcolloy stainless cast iron, which is very resistant to wear and takes a high finish.

The two six-wheel bogies are themselves articulated to take curves of 2 ft. 6 in. radius, but the pivots allow no vertical movement, to reduce the chance of the leading wheels jumping the track. All wheels are sprung.

The motor is built round an old vacuum-cleaner armature; a permanent magnet would have been fitted if a suitable one could have been found. Further details will be given later.

The reverser rotor is a permanent magnet from a bicycle dynamo. Since the stator carries the winding, there are no pig-tail connections. It is connected in parallel with the field windings, which it reverses, so that it is wound with fairly coarse wire, 32-gauge, and the current used by it does useful work in the armature.

Method of Drive

The view of the underside of the locomotive shows the method of transmitting the drive to all axles. Enclosed skew gearboxes on each axle have their driving-shafts above the axles lying on a common axis with the second reduction shaft on the motor and gearbox assembly, which is central between the bogies. The whole lot are connected together by universal joints.

The motor and entire transmission run on home-made ball bearings, thirty in all. The sixteen helical gears are also home-made. The overall gear ratio is 4-to-1, a low ratio to keep down noise and friction, but full tractive effort is obtained.

It can be seen that a good deal of repetition work was involved, especially in making the transmission. The gadgets fitted to my 3½-in. Drummond lathe for this type of work are: a toolpost at the back of the saddle to hold the parting-tool, and a dial-index on the leadscrew handwheel. With the added help of a double-edge tool on the regular toolpost, small parts can be bored, turned, faced and parted without changing any tool settings, using the dial-index readings alone to copy accurately the first one off.

The form tools for cutting the gear teeth were finished by using a microscope of 33-to-1 magnification. The tool was placed under the microscope and, with both eyes open, was compared with a paper held alongside on which the shape had been worked out on the drawing board to the same magnification.

The Motor

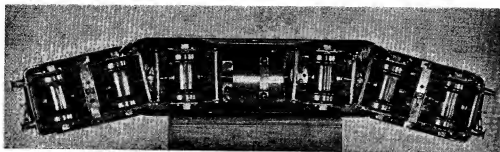
This motor was designed to get the greatest possible size in the space available, the armature shaft being arranged lengthwise along the locomotive, with the field coils at each end beyond it.

The armature is from an old vacuum-cleaner, about 1½ in. diameter by ¾ in. long, with thirteen slots and twenty-six segments on the commutator. The shaft was cut short at the fan end and re-centred, using a piece of wood in the toolpost for a steady.

The new winding was 30-s.w.g., in two parallel circuits, as that size of wire was available. This is equivalent to a single winding of 26-s.w.g., and suits a 16-volt supply.

Points to note in winding an armature of this type and size are:—

(1) To find the number of turns which can be wound in each slot, work out the area of a slot after inserting the presspahn insulation, calculate the number of turns to fill that area, either from



Underside of locomotive, showing all axles driven

wire-tables or by measuring the diameter of the wire to be used, and then take about 60 per cent. of that number as the actual number of turns which can be put in.

(2) Some sort of winding machine must be rigged up to hold the armature and turn it end over end by means of a handle, stiff in its bearings, so as not to unwind while both hands are busy with the wire.

(3) A few coils should be wound with scrap wire as a dress rehearsal before starting the proper job. This should include working out a scheme for identifying the ends of the coils, since there are four ends emerging at each tooth, there being two coils for each slot.

(4) Cellulose adhesive tape is useful for insulation. Every coil end has a piece of tape nipped round it where it leaves the slot, and it is also used between the coils, especially where they leave the slots and where the end windings of different coils overlap each other.

(5) A few tapered slips of hardwood are handy for temporarily holding end wires in place.

(6) The bench must be cleaned well before starting, and no metal allowed to touch the wire while it is being handled.

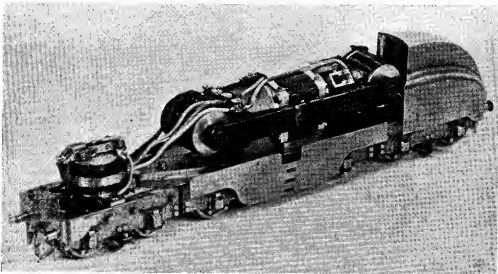
(7) A binding of half a dozen turns of linen thread through the slots and over the end windings will hold the latter in place against centrifugal force.

(8) A good soaking with shellac varnish will cement the loose turns and prevent the risk of loose wires chafing under vibration and causing short-circuits.

(9) Balancing of the final job is well worth while. Slips of brass are pushed into the slots above the winding, with presspahn underneath them, to add weight where needed.

The pole-pieces were made of flat steel bar, with 1-in. thick brass plates bridging them top and bottom. The four pieces were silver-soldered together and then machined as a single piece. The bottom brass plate forms the base for attachment of the motor to the locomotive. The air-gap is 0.006 in., and the pole tips are cut at an angle to avoid binding on the armature teeth.

Originally, two telephone magneto magnets were clipped to the pole-pieces, but they were not strong enough and were replaced by wound magnets. The field windings are of about 21-s.w.g. wire taken from old car dynamo field coils. The two coils are connected in parallel and



Cover removed to show arrangement of motor

the resistance is only $\frac{1}{2}$ ohm. It is best to design the largest possible field coils and then thick wire can be used, with a low voltage loss.

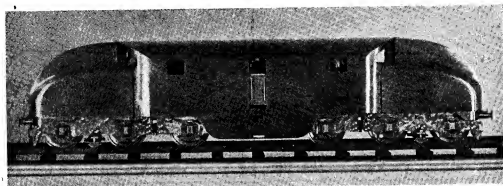
The end-shields are aluminium castings, spigoted into the armature tunnel.

The brushes are copper-carbon, cut from a brush from an old motor-car starter motor.

were locked by a drop of shellac varnish in the threads.

The rest of the transmission runs in similar ball-races.

The bore of the outer races was calculated, after choosing a suitable number of balls, n of diameter d (actually $\frac{1}{8}$ in.) by the formula:—



Side view of the complete locomotive

The brush-holders are carried on a ring, so that their position could be adjusted in the final testing to get equal performance in both directions of rotation. Brush spring pressure must be capable of fine adjustment.

The ball-bearings were formed by hardened 90-degree cones pressed on the shaft for the inner races, and outer races of the bicycle-hub type with a fine thread on the outside diameter to adjust them in the end-shields. Their adjustment was left a shade slack to allow for the warming-up of the armature shaft, and after the test run they

$$\text{Bore } D \text{ in.} = d \cdot \text{cosec} \frac{180^\circ}{n} + d + 0.005 \text{ in.}$$

A block of steel, screwed to the underside of the end-shield, carries the first reduction shaft in its bearings, and a second block screwed to it, and also to the brass baseplate under the pole-pieces, carries the hollow, splined second reduction shaft, from which the cardan shafts take the drive to the bogies. This construction allows the meshing of the gears and the adjustment of the bearings to be done and tested before fitting the assembly into the locomotive.

Blundell Slide-Rules

A VERY interesting new type of slide rule has recently been introduced by Messrs. Blundell Bros. (Luton) Ltd., Engineering Division, Chaul End Lane, Luton, Beds. It is produced by an entirely new and patented process, and is a complete breakaway from methods and materials previously employed. The use of boxwood, ebony, ivory and similar materials has been discarded in favour of high quality laminated phenol base plastic; which is thoroughly seasoned before use to avoid possible distortion or alteration of dimensions, and the sliding members are machined from the solid. The need for corrective or wear-compensating devices formerly found necessary has thus been eliminated.

A special method of process-engraving has been evolved for producing the scales, which ensures extremely high accuracy of the divisions, and by making them on a hard surface of stoved enamel, both legibility and durability are ensured.

From an inspection of a sample, we have formed a high opinion of their accuracy and sound construction.

At present, three types of slide rule are in production, all 10 in. in length; the type G2, a general-purpose rule with the usual ABCD scales, cubes and squares, reciprocal and mantissae scales on the working face, and a useful set of constants on the back; type E3, designed mainly for electrical calculations, and incorporating scales to facilitate working out voltage drop, dynamo and motor efficiency, temperature changes and cosine scale for A.C. power; type L4, with the usual ABCD and reciprocal scales, upper and lower log/log scale, and constants on the reverse side. Other types in preparation are the type G5, similar to the G2 but with trigonometrical scales on the underside, and the L6, a somewhat similar modification of the L4.

THE INTERNAL COMBUSTION TURBINE

by A. H. Poole, A.M.I.Mar.E.

THE order of development of prime movers has been from the steam reciprocating engine to the steam turbine, and hence to the reciprocating internal combustion engine which at the present time offers intense competition to both the first mentioned. We now find that just as the steam turbine proved more successful and efficient than the reciprocator, the latest develop-

pumps several times as much air into the combustion chamber over and above the amount required for efficient combustion of the fuel. This arrangement is to keep the temperature of the gases after combustion to within the limits imposed by the materials available for the engine construction. On leaving the chamber the gases pass to the turbine, which contributes two-thirds

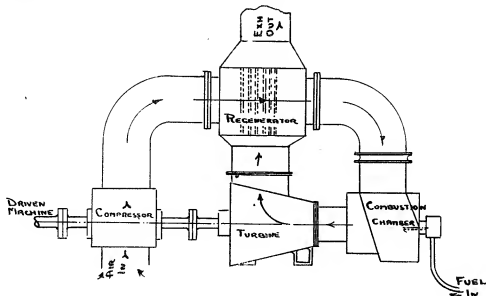


Fig. 1

ment in prime movers, the internal combustion turbine, will in its turn prove to be the most efficient heat engine so far produced. The model engineer can and does produce new ideas and principles which prove useful when applied to the full-size commercial engine. The writer hopes that, by bringing the internal combustion turbine to the notice of model engineers, the unfortunate lack of interest shown in the diesel engine in this country during the early part of this century, will not be repeated. The result of this has been a scarcity of successful designs of diesel engines of pure British origin. The modelling of this engine will provide in its design and execution a variety of problems which, if satisfactorily solved, may do much for its future development.

The basic principles of the engine are relatively simple and straightforward, the general idea can be seen in Fig. 1. The cycle starts with air being drawn into a compressor from the atmosphere and discharged at about 85 lb. per sq. in. gauge into the combustion chamber in which is burnt the fuel oil. This raises the temperature of the air to about 1,200 deg. F. The compressor

of its power output to driving the compressor and the remaining third is available for useful work. Of course, work expended in driving the compressor is regained when that air expands in the turbine after combustion. The output power plus loss in inefficiencies is obtained from the heat energy released by the burning fuel. The gases after driving the turbine pass into a heater whereby compressed air is heated before going into the combustion chamber. This heat exchanger is called a regenerator and by fitting one as shown in Fig. 1 a great increase in efficiency is gained. After heating the compressed air the gases exhaust to atmosphere at a temperature of 400 deg. F. and a pressure of about 5 lb. per sq. in. above atmospheric pressure.

A few points of design and layout may be discussed now; firstly, a rotary type of compressor is the most satisfactory kind because a reciprocating type would involve the use of gears to bring the turbine speed of somewhere between 3,000 and 4,000 r.p.m. to a suitable speed for the compressor. The working pressure of this pump could be arranged at a lower pressure than that used in full-scale practice, a pressure about 60 lb.

per sq. in. gauge would prove satisfactory and the various parts of the pump would not be subjected to high temperatures.

The next main unit, the regenerator, is very much akin to the economiser except, of course, air at a pressure is heated in the place of feed water. Fig. 2 shows a type of regenerator attached to a combustion chamber, the exhaust gas tubes

Starting is achieved by first heating the combustion chamber and then a stream of compressed air from a storage tank is used to allow the ignition of the fuel by means of a hot wire or spark. The cycle then begins and as the turbine builds up speed a supply of compressed air is maintained by the air compressor.

There are several different means of connecting

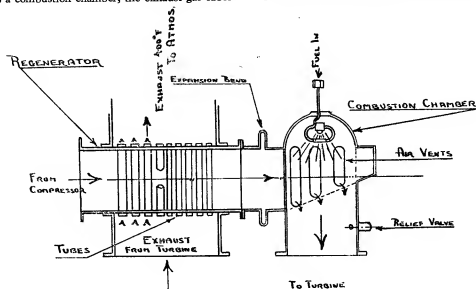


Fig. 2

are shown expanded into the tube plate forming the regenerator sides. The temperature of the compressed air leaving this unit and entering the combustion chamber varies in the region of 600 deg. F. and 700 deg. F., depending upon the type of design used.

The combustion chamber must be stoutly made and tested to within six times its working pressure. The chamber shown in Fig. 2 has air vents arranged around the fuel nozzle so that a swirling motion is given to the air to assist combustion. The high temperature at which the unit works necessitates an efficient system of screening and lagging to prevent loss of heat. At the centre of the hemispherical end is shown the fuel nozzle which would probably burn paraffin best. Whatever fuel is chosen, it must be pumped at a high pressure and preferably preheated to ensure proper atomisation and therefore combustion.

The turbine presents the same problems as are associated with steam construction. An impulse type turbine revolving at high revolutions is a most suitable arrangement. Complications arise from the high temperatures used which make necessary the protection and cooling of the bearings, and allowances for expansion by securing one end of the turbine casing only, the other end being free to slide as the machine warms up. All possible care throughout the engine must be taken to limit and control expansion for this will vary from point to point. The most satisfactory material to use throughout is steel, preferably an alloy of nickel and chromium.

the turbine to the driven machine. The most popular method appears to be by electrical transmission. A few internal combustion engines have been successfully built, an American naval craft is powered by this engine driving a generator which supplies the necessary power to the electric motor turning the propeller. A similar electric drive has been used on a locomotive running on one of the Continental railways. Generally speaking, the pressures used are not excessive and can readily be obtained in a model. It may be found that a working pressure lower than 80 lb. per sq. in. would suffice. A successful working model or more aptly experimental engine, not model, would be useful and perhaps contribute fresh ideas to be incorporated in the full-size engine.

Exhibition at Portsmouth

Mr. H. A. Handsford, the indefatigable hon. secretary of the Portsmouth Model Engineering Society, informs us that the Society's Annual Exhibition will be held this year at the Southern Grammar School, Highland Road, Southsea, from August 6th till the 16th next. The official opening will be performed by the Lord Mayor of Portsmouth, Councillor R. J. Winnicott, at 2.30 p.m., on Wednesday, August 6th. The arrangements are being planned on a much more ambitious scale than previously, with a view to producing the best show of its kind ever seen on the South Coast.

THE M.P.B.A. INTERNATIONAL REGATTA

THE Model Power Boat Association presented, on Sunday, June 8th, at Victoria Park, the first post-war International Regatta to be held in this country.

The absence of Monsieur G. Suzor was regretted by all. This was due, however, to the French railway strike, which unfortunately coincided with the regatta date.

One of the brighter occurrences was the re-appearance at the pond-side of several of the crack power boat enthusiasts of former days, and the attendance of provincial clubs.

Flash steamers were well to the fore, no less than eight being present; in fact, the day turned out to be a flash steam benefit, all three events being won by flash boats. Not long ago there was talk of flash steamers as being almost defunct; but now it seems that the petrol engine enthusiasts will have to look to their laurels. This revival, however, is all to the good; one of the most interesting points in model power boating is the various designs of plant it is possible to install, whether steam or I.C. In actual fact, hardly any two engines or hulls are alike!

The order of running in the regatta was decided by draw, and a time limit of 3 minutes



Mr. Martin's "Tornado III," which put up a fine performance in the Wico-Pacy Cup Race



A 30-c.c. two-stroke of original design, with Rankine type flywheel magneto, features in this promising boat by Mr. N. H. T. Meageen, formerly a well-known motor-cycle race driver

was given to commence the run. This arrangement worked well, the usual long delays being conspicuous by their absence.

The first event of the day was the Class C (10-c.c. or 5-lb. steam) race for the Wico-Pacy Cup, over 500 yards.

There were only five entries for this event. Mr. Heath (Victoria), with *Derive*, was No. 1 in the running order, but *Derive*, after starting well, promptly cut out. Mr. Cruickshank (Victoria), with *Defiant II*, did exactly the same. Mr. A. Martin (Southampton), with his flash steamer *Tornado III*, was next, and put up a clean run. Mr. Weaver (Victoria), had the same ill-luck which befell his colleagues, and the first round ended with only Mr. Martin's *Tornado III* completing the course.

On their later attempts, all the competitors managed to return a time. Mr. Martin improved his performance to 37.71 sec. (28.04 m.p.h.), and Mr. Cruickshank, after starting with too rich a mixture, saw *Defiant II* accelerate towards the end of the run to get second place.

Due to the number of entries being small, there were only two prizes for this event.

Result:—1st Mr. A. Martin. *Tornado III*. 35.71 sec.



A hardy veteran; Mr. G. D. Noble, of Bristol, whose boat "Bulrush VIII" made a good show on its first post-war run

2nd Mr. J. Cruickshank. *Defiant II*. 31.71 sec. During the lunch interval which followed, a number of prototype and free-running boats were in action for the benefit of visitors, and they were much admired. The next event was the Miniature Speed Championship for Class B (15 c.c. or 8 lb. steam) boats, over 500 yds.

No sensational speeds were recorded in this event, the winning boat taking 1.2 sec. longer to complete than in the class C event.

Mr. Walker (Malden), with *Petite*, a two-stroke engined boat, had the misfortune to cut out when on his fourth lap, and he subsequently withdrew *Petite* on account of engine trouble.

No. 2 on the list, Mr. Jutton (Guildford), caused something of a sensation when his flash steamer *Frisky* snatched on the line, and changing course, cut the line and went straight into the bank, luckily not at full speed; the foredeck, however, was badly damaged. Mr. Cruickshank, running his 10 c.c. *Defiant II* on another propeller in this event, saw it promptly roll over as it left his hands; this event occurred twice during the race, much to the entertainment of the spectators.

Mr. Martin, with *Tornado IV*, showed the petrol boats how to do it with a trouble-free run, although below the best speed of this boat; his time was 36.91 sec. (27.68 m.p.h.).

Among the interesting boats in this event was a 15 c.c. "Suzor" type engine by Mr. L. Purple (Blackheath), but adjustments are obviously required before the full potentialities of the design are realised.

Mr. Weaver (Victoria), with his 10 c.c. boat *Wizard of Oz*, secured second place with the time of 39.86 sec. (25.65 m.p.h.), improving considerably his performance in the Class C event.

Result—1. Mr. A. Martin, *Tornado IV* 36.91 sec.

2. Mr. Weaver, *Wizard of Oz* 39.86 sec.
3. Mr. Duffield, _____ 49.7 sec.

The final event of the day was the International Race for A Class boats (30 c.c. or 16 lb. steam).

Speeds on the whole were much higher than in the previous events, and some good runs were put in by several competitors. There were four flash steamers in this event, but Mr. Marsh (Southampton), had to scratch *Sea Devil III*, owing to boiler trouble, and Mr. Lines (Orpington), with *Blitz II* had water pump trouble, which caused the boat to peter out. Mr. Meageen (Altrincham), with *Samuel*, twice got away on a slack line and capsized, but at last succeeded in completing the course.

The best performances were put up by Messrs Noble, Parris, Clifford, Tompkinson and Cockman. The consistent running of their respective boats was an object lesson. Mr. Pilliner (Guildford), did quite well with his flash boat *Ginger*, but the blowlamps appeared to give a lot of trouble.

The "International" is now open to steam boats as well as petrol engined boats, for the first-time, and Mr. Cockman, with *Ifit VI*, just
(Continued on next page)



Mr. A. Weaver, whose boat "Wizard of Oz" won second place in the Miniature Speed Championship

The Montreal Live Steamers Corporation

WE recently mentioned that our "live steam" friends in Montreal had received official recognition of the incorporation of their club as a State approved body. The following extract from the Charter granted by the Province of Quebec defines the objects for which the Corporation has been formed and has received official sanction. We have omitted the usual legal preamble and final testimony as to the affixing of the Great Seal.

Here are the approved objects of the Corporation:—

To own and operate a miniature or garden-size railroad track for the pleasure, education, and enjoyment of its members who may be engaged in the hobby pursuits of building, operating and experimenting with miniature or garden-type locomotives operated by any kind of motive power and including the operation of miniature or garden-size trains on which persons may be transported without remuneration; . . .

To take, hold, possess and acquire by purchase, exchange, lease, grant, subsidy, donation, devise, bequest or otherwise and to sell, transfer, make over, assign and otherwise alienate, dispose of and deal with property of all kinds, moveable and immovable, real and personal, tangible and intangible; . . .

To purchase or otherwise acquire and undertake all or any of the assets, property, privileges, contracts, rights, obligations and liabilities of any other corporation, society or person carrying on any activities which the corporation is authorized to carry on, or possessed of property suitable for the purposes of the corporation; . . .

To amalgamate or enter into any arrangement for union of interests, co-operation or otherwise, with any other corporation or any society or person carrying on or engaged in any activities which the corporation is authorized to carry on or engage in; and to lend money to, guarantee the contracts of, or otherwise assist such corporation, society or person; . . .

To enter into any arrangement with any government or authority, municipal, local or otherwise, that may seem conducive to the corporation's objects, or any of them, and to obtain from any such government or authority any rights, privileges and concessions which the corporation may think it desirable to obtain, and to carry out, exercise and comply with any such arrangements, rights, privileges and concessions; . . .

To adopt such means of making known the activities and objects of the corporation as may seem expedient; . . .

To invest and deal with the moneys of the corporation not immediately required in such manner as may from time to time be determined; . . .

To subscribe, draw, endorse, transfer, make or accept bills of exchange, promissory notes and other negotiable instruments under the signature of its officers or others as may be determined by its board of directors in virtue of the powers, rights, and attributes conferred upon the corporation; . . .

To do all such other things as are incidental or conducive to the attainment of the objects and the exercise of the powers of the corporation but neither to permit gambling games, games of chance nor games of chance and skill mixed, nor to obtain nor hold any club licence from the Quebec Liquor Commission. . . .

The corporate name of the corporation to be

"MONTREAL LIVE STEAMERS CORPORATION"

The chief place of business of the said corporation to be at *Montreal*, in the District of *Montreal*, . . . in Our said Province.

The amount to which the value of the immovable property which the corporation may hold, is to be limited, is Fifty Thousand Dollars (\$50,000.00). . . .

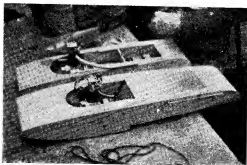
The M.P.B.A. International Regatta

(Continued from previous page)

beat Mr. Parris (South London), *Wasp* III, for first place.

Among those suffering ill fortune were Messrs. L. Pinder and E. Clark whose respective boats, although showing excellent speed, simply would not complete the course.

Result—1. Mr. Cockman, *Ifir* VI. 25.39 sec. (40.29 m.p.h.). 2. Mr. Parris, *Wasp* III. 26.5 sec. (38.6 m.p.h.). 3. Mr. Clifford, *Crackers*. 27.36sec. (37.39 m.p.h.)



"Wizard of Oz" and a smaller sister were both entered in one race by Mr. Weaver

Among the visitors was Mr. Rankine of Ayr, and great sympathy was expressed to him, when it was learnt that both the *Oigh Albas* had been destroyed in a fire.

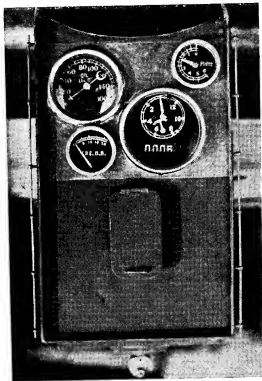
The day ended with the presentation of the trophies by Mr. E. Vanner, who congratulated the winners on their performances, and so the first "International" since the war came to a successful conclusion.

Interesting Blobs and Gadgets

ONCE again the postman has rung the bell and departed; once again your humble servant finds on the doormat a packet with the address written in a familiar and welcome handwriting; once again, I anticipate that the contents are going to be interesting, not only to myself, but to all followers of these notes; so once again I have the pleasure of bringing to your notice the latest wheezes evolved by that versatile architect engineer, Mr. Edward Adams, who needs no further introduction.

Some time ago, our worthy friend started on a locomotive of the type which has a boiler like the body of a "Jerry Spaniel"—though not quite as flexible—and the 4-8-8-4 wheel arrangement with a huge bogie tender to suit. Now anybody driving a locomotive of this type, when sitting on a flat car behind the tender, has a dickens of a job to see the steam gauge well up under the roof of the cab, especially when Anno Domini begins to play tricks with one's eyesight; so Mr. Adams thought it would be a good idea to bring the gauge back on to the tender tap, where it could easily be seen. Whilst contemplating this, and arranging for the necessary connections, he had another idea. It was his intention to use the big tender for testing purposes, being (like my own), capable of being attached to any of his locomotives; so he thought, why not fit up a regular instrument panel, on top of the tender, similar to the sort of thing you find on the dashboard of an automobile, complete with speedometer, water-level gauge, and tractive effort recorder? In our friend's case, the thought is parent to the deed; so he promptly got busy, and the result you see in the pictures and drawings. He says he is a confirmed rebel, and outside the pale of the "scale fanatics," so offers no apology for an unorthodox arrangement; yet for my own part, I reckon he is

actually following big practice, for if a "full-size" locomotive engineer arranged his gauges in a panel, he would naturally put it in the best position for the driver to see it all the time, and that is exactly what Mr. Adams has done, as he is obviously too big to ride in the cab. Well, here are a few particulars of the "clocks," as we used to call the gauges on the old Brighton engines, and some notes on how they work.

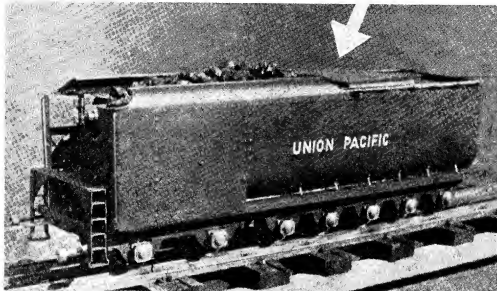


Bird's-eye view of the "clocks"

Speedometer and Mileage Recorder

The speedometer is one of the magnetic type sold for push bicycles. The mileage recording part of the business was arranged by fixing up a worm gear, driven from one of the tender axles; the worm is on the axle, the wheel being fixed to the star-wheel spindle of the speedometer. The reduction is 6 to 1; and the tender wheels being 1½ in. diameter, the accuracy is near enough for the purpose required. The reading could be made absolutely "spot on" by turning the treads of the wheels to the exact "mike measure" needed.

The speedometer part of the gadget was arranged to read to 40 miles per hour obviously much too high for a circular 2½-in. gauge line, the average speed being about 8 miles per hour, and the highest safe maximum about 12. This obviously meant only a small movement of the pointer, and a rather unsatisfactory reading; so some arrangement of gearing up, to increase the movement of the needle, was called for. Mr. Adams tried winding some turns of iron wire on the stator—the "tin lid" arrangement connected to the needle, and operated by the revolving bar magnet—but this did not pan out well, the instrument being too sensitive; and in any case it would have needed a fresh limiting hair-spring, and also re-calibrating. It was decided to try and gear up the existing



Mr. Ed. Adams's testing tender

spindle; and the arrangement shown in the picture, did the trick fine.

A quadrant and pinion were obtained from an old car pressure gauge; Mr. Adams says these were beautifully made, and saved a lot of work. The quadrant was attached to the original pointer or needle spindle of the speedometer. A new smaller needle was made, and mounted on a spindle running in printed bearings at both ends, as the absolute minimum of friction is essential for correct indications. The pinion was mounted on this spindle, and the whole doings assembled as shown in the photograph, a new off-centre circle being drawn to suit the length and position of the needle. This was calibrated in miles per hour by aid of Mr. Adams's son Michael, and a clock with a second hand, the time taken for a lap of the continuous track being noted; the miles per hour was then a simple calculation, the exact length of a lap being

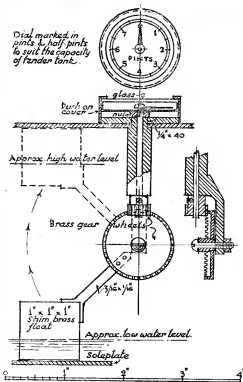
known. The new scale is very "open," and the exact speed from zero to 12 miles per hour can be read at a glance.

Tractive Effort Indicator

This is a simple rig-up, the dial and pointer indicating the exact actual drawbar pull all the time the engine is running. A coil compression spring of known strength, is mounted on an extension of the drawbar hook, and operates a lever at the bottom of the vertical shaft leading to the dial. The latter was calibrated by applying a spring balance to the coupling hook. The numbers were first put in with a fine pencil, and then in thin white paint applied with a drawing pen.

Water Level Indicator

Mr. Adams kindly forwarded a drawing of this gadget, which you will see reproduced here. It is very simple and consists of a crown wheel operated by a lever and float, the wheel actuating a small pinion mounted



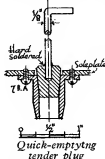
Details of the water-level indicator.

on a spindle, the upper end of which projects through the tank top, and carries a needle or pointer working over a dial, calibrated in pints and half-pints. Actually, the needle of the existing gadget goes the opposite way to the one shown in the drawing, the crown wheel being on the opposite side of the pinion. The wheels came out of a Mecanno set. The float is located at the centre of the tank, which minimises error when the engine is on a gradient. Calibration was done by placing the tender on a level part of the line, pouring in measured half-pints of water, and marking the dial accordingly. The tender can be quickly emptied by lifting the plug shown in the accompanying drawing, which is self-explanatory.

The panel itself has brass tubular pockets on the underside, for housing the steam gauge and the speedometer; the whole lot is easily detachable, and can be lifted out entire, if necessary. Provision is made for Inspector Meticulous also; for if that worthy happens to come along "on the warpath," as we used to say about the "gaffer" in the locomotive sheds, the whole bag of tricks can be obscured by the shallow cover indicated by the arrow in the photograph of the tender. The latter, incidentally, is a copy of one of the largest and latest American type tenders, having a semi-Vanderbilt body, and running on 14 wheels, five pairs running in rigid axleboxes, and the leading two being mounted on a bogie, as in a 4-10-0 locomotive.

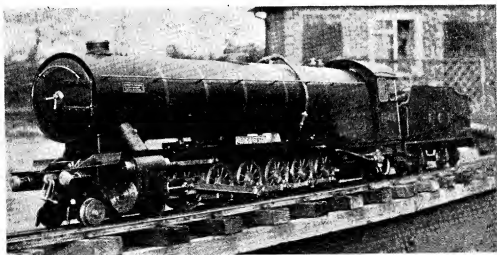
Mr. Adams specifically points out that he has not the slightest intention of ever becoming a "statistics fan" (loud cheers from Curly), but he says it makes things interesting, as he found when running trials with his "Caterpillar" type engine, and the gadgets were well worth the trouble of making and fitting. Your humble servant fully agrees, and offers congratulations

for displayed ingenuity and excellent workmanship. Speaking of the "Caterpillar"—this one's name is "Leadbetter"—here is a picture of her. Note the whacking great cylinders, also the position of the top feed pipes. They were arranged thus, to obviate any chance of the feed water coming into contact with the main steam pipe between the dome and the smokebox. One side takes the feed from the eccentric-driven pump, and the other from the injector, which can be seen at the side of the firebox. A fine, powerful engine indeed, and an asset to the Falls Grove Railway.



Flashbacks on "Hielan' Lassic"

When describing how to build a locomotive, in these notes, I try always to make everything as clear as possible, not only to aid beginners who set out cheerfully to build one, even if they didn't know previously what pushed the piston up and down the cylinder, or even what cylinders and pistons were; but to save myself a lot of unnecessary correspondence from folk who were hazy on some point or other, and wanted individual direct explanation. This usually pans out as expected, correspondence about the actual job being amazingly low, and the "Lassic" is no exception to the rule. However, I assure you all that it is a real puzzler to try to think of everything, and anticipate everybody's queries, especially as the onward march of Anno Domini, the antics of Adolf and Co., and the present conditions of living (or should I say existence?), have all done their bit towards slowing down the capacity of my now-nearly-worn-out noddle. Just recently I have been kind of "reviewing" the notes on "Hielan' Lassic," in conjunction with a few odd letters received, asking information on certain points; so to save further queries on the same subjects, maybe it would not come

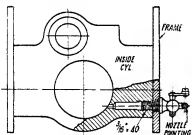


The Falls Grove "Caterpillar"

amiss to have a little lobby chat about the points raised. Incidentally, I would remind beginners that you cannot erect a powerful passenger-hauling locomotive as easily as a radio set, or a toy locomotive of the "O gauge externally-fired" variety, with a screw-driver and a pair of pliers; some intelligent fitting work is called for, exactly the same as in full size practice. Well, pass the tea-bottle, Montmorency, and let us hold forth.

Drain Cocks for Inside Cylinder

Piston-valve cylinders, as previously stated, need drain cocks, and these are easily fitted, as specified, to the outside cylinders; but owing to the proximity of the bogie bolster, there isn't sufficient room for them directly underneath the inside cylinder in the usual position. Provided that the water can escape between the piston and the cylinder cover, it doesn't matter an Assouan about them being exactly at the bottom, and the more experienced builders of the "Lassie" who are using piston-valve cylinders, know this quite well, and have put them to one side, sufficiently to clear the bolster. However, there is a way out (literally!), which makes the job simple to the point of absurdity, and the reproduced sketch shows it. The hole for the bottom fixing screw at each end of the inside cylinder lugs, is drilled $5/32$ in. almost to the cylinder bore, and a $1/8$ -in. hole continued from the end of it, right into the bore, as described when dealing with the cylinder cocks. The end is tapped $3/8$ in. by 40 in., and the hole in the frame en-



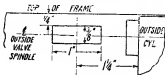
Outside drain cocks for inside cylinder

larged to $3/8$ -in. clearing (No. 12 drill). The two cylinder cocks are screwed into these holes, as shown, taking the place of the screws. There is nothing outside the frames at this point, the outside cylinders being set well back. The cocks should have little nozzles of bent tube pointing ahead, same as described for "Petrolea," and the handles connected by a short rod on top. This saves all fiddling work between frames, and is not unsightly.

Opening in Frame for 2-to-1 Levers

The distance between piston rods and valve spindles on the piston-valve type of cylinders, being only $1\frac{1}{8}$ in., the slots in the frames for the ends of the levers of a 2-to-1 valve gear, used with these cylinders, will need to be lower in the frames than if used with slide-valve cylinders. In the latter case, I specified a gap 1-in. wide, cut down from the top of frames; but there is

no need for this with the piston-valves. The accompanying illustration shows a suitable slot, entirely enclosed, and preventing any weakening of the frames by an unduly large piece being taken out of them. Merely cut a slot at each side, 1-in. long and $3/8$ -in. wide, halfway between the inside and outside cylinders, and on the centre-line of the piston-valve spindle. The

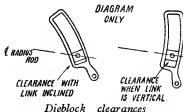


2-to-1 gear slot for piston-valve cylinders

slot is inclined at an angle of approximately one degree, the front end being $1/4$ -in. below the top edge of the frame, as shown. The easiest way of cutting it would be to mark out the rectangle, and drill a $1/8$ -in. hole dead in the centre. Drill another at each side of the first, touching it; then finish with a file to rectangular shape.

A Question of Valve Travel

There was one thing I *did* expect, and strangely enough didn't get, and that was a lot of quibble about the valve gear, especially the early cut-off; but only one fraction of one per cent. raised the question, the vast majority being quite content to trust to old Curly, and the reputation of all his other locomotives! A beginner said that a club "knowledge-box," as we used to call them in the locomotive sheds, sneered at the position of the dieblocks in the links with the lever in full gear position, and said there wasn't half enough valve travel; so he checked the port openings, and found the cut-off to be a little over half-stroke, say about 60 to 65 per cent., and wanted to know if this was all O.K. It certainly is; the late Sir H. N. Gresley, was a great believer in limited cut-off for all his three-cylinder engines, and to the best of my knowledge and belief, 65 per cent. was the maximum cut-off in full gear. With this, the Pacifics had not the least difficulty in starting trains of 600 tons or



Dieblock clearances

more. There is a kind of "freemasonry" among engineers—incidentally, many of them actually are "on the square"—and I have received plenty of direct information; but if anybody wants confirmation, they have only to read the accounts of various performances of Gresley engines, chronicled by Mr. O. S. Nock, whose experience of footplate trips is unique and extensive.

Being a personal believer in early cut-off, I arrange my valve gears in similar manner; and in any case, the lever should not be in full gear position after the first few turns of the wheels, but the engine should be notched up as the speed increases. The dictum "that expansion of steam in small cylinders is all rubbish," is in itself all rubbish, as I have proved again and again. Just before I wrote these words, a S.R. 2-6-0 (Maunsell-designed "N" class) went by, plodding steadily up the 1 in 264, with 45 loaded wagons and a bogie brake van behind her tail, the die blocks being so close to the middle of the links, that the radius rods were barely moving. She was doing the job practically on the "lead" steam; but as she has Walschaerts gear, the lead is constant, and she has to kick off from a dead stand with the same amount of lead as is necessary to run at a high speed. Yet these engines start readily with a full load—personally I have never seen a case of a driver having to reverse—and nobody could complain about the acceleration; which just goes to prove what a lot of utter tommy-rot is written about "negative lead." Bless your hearts and souls, it is just the abolition of such ancient shibboleths, and the substitution of a "common-sense" valve setting, that enables locomotives built to your humble servants' specifications, to do all I claim for them, plus a bit extra for luck! I found out all those fallacies about 40 years ago, and started exposing them even before the "Live Steam" notes made their appearance; as proof, consider not one, but the hundreds of "Live Steamers" now running, including the great-great-grandnanny of them all, old *Ayesha*, still going as well as ever!

Returning to the "Lassie" valve gear, beginners should take a look at the diagram shown here, and recollect that the end of the link slot describes an arc, as the link oscillates on a pivot, whilst the dieblock moves in a straight line; the end of the radius rod is guided by a straight slot in the lifting arm, and the dieblock is attached to it. When the link is inclined, the block will be near the end of the slot, as shown in the left-hand illustration; but when the link is in mid-position, it will be an appreciable amount nearer centre, as the right-hand sketch shows. If the reverse gear is set so that the minimum clearance is allowed when the link is vertical, it will hit the end of the slot when the link assumes its maximum inclination at each end of its movement. If any builder isn't satisfied with the setting I gave, and wishes to increase the full-gear valve travel, he has only to set the dieblocks as close to the ends of the slots as possible, *with the link fully inclined either way*, connecting the reach-rod higher up the reversing lever; but it is a waste of time, because the engine should be notched up after the first few puffs, and the running position, with all the load the engine can haul, will be with the dieblocks almost in mid-position. Just the same, in fact, as in the case of the S.R. "Mogul" mentioned above.

Single Chimney

Several readers who prefer the old type of single chimney as fitted to the earlier Gresley

Pacifics, want to know what difference there will be in the blastpipe and blower arrangements if this is fitted. Very little; the exhaust pipes and the connecting block on top of the inside cylinder, can be exactly the same, as far as erecting and fitting are concerned. The block should be made from a piece of $\frac{1}{2}$ -in. by $\frac{1}{2}$ -in. bar, instead of $\frac{1}{2}$ -in. square, and a $\frac{1}{2}$ -in. hole drilled midway between the positions given for the original twin blastpipes. In this is fitted a $\frac{1}{2}$ -in. blastpipe 1-in. high, surmounted by a cap made from $\frac{1}{2}$ -in. hexagon brass rod, and drilled $\frac{1}{8}$ -in. at the nozzle. The blower has a single ring instead of two, otherwise it is made in the same way.

The chimney liner should be the same length as given for the double chimney, but made from a piece of $1\frac{1}{2}$ -in. brass or copper tube, silver-soldered to a square plate curved to the inside radius of smokebox, and attached by a screw at each corner, as described. The outer chimney is a casting, and only needs turning and boring to fit over the liner; if a tight push fit on same, no further fixing is needed.

Second Thoughts are Best

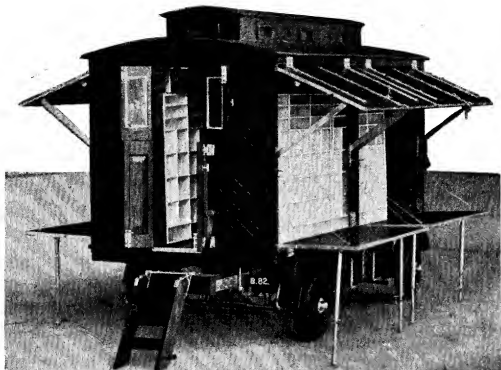
There was one thing I clean forgot to mention when dealing with the building and erection of the boiler. When I first schemed out the tentative design, it was my intention to specify a boiler having a firebox the same width as the trailing cradle, *viz.*, 5 in., and the reversing gear stand and reach rod were arranged to clear a firebox of this width. However, when it came to the time for going into details of the boiler, I found it would be easy enough to accommodate an extra inch of width, giving the enginemmen "a bit to play with," in a manner of speaking. "Bantam Cock" has a 5-in. firebox only, but she has only two cylinders. Anyway, I made the drawing of the boiler with a 6-in. firebox, and described it; but when it came to the erecting, I forgot to mention that the existing reach rod would have to be altered to clear the extra width of the firebox.

There is no harm done; it is easy enough, and not a long job, to lengthen the reach rod sufficiently to allow it to be bent to clear the firebox and attached to the existing stand. Builders who have not yet put the fittings on their boiler, should mount it temporarily on the chassis, and mark on the backhead, a position for the left-hand clack and washout plug, that will leave them clear of the reverse gear stand. If the holes have already been drilled and tapped, they can be plugged with screwed stubs of copper rod, anointed with plumbers' jointing, screwed in tightly, cut off and filed flush. This will make no difference at all to the strength of the boiler.

Tail Lamp

The following is an extract from a recent issue of the *Evening News*. Under the heading "Brighton Beats the Loco. Crisis," it says: "Brighton, so long renowned for rock, bathing belles, wheels and what-the-butler-saw, has a new claim to fame—railway engines." My italics; golly, aren't these daily press reporters hot at getting up-to-date news—the first locomotive built there, left the Brighton Works in May, 1852!!

The Tale of a Trailer



AT the end of the 1938-39 Waziristan Campaign on the north-west frontier of India, I happened to be commanding a Combined M.T. Workshop Company in Mirali, Waziristan, when I received a request through District H.Q. to submit a design to G.H.Q. for a stores trailer.

Plans and blueprints were prepared and duly submitted through the usual channels to District H.Q. A few days later a certain staff officer, who happened to be a friend of mine at District H.Q., rang me up thanking me for the plans, saying that they appeared to be just what was required, but as the then Director who controlled our destinies was "mule-minded" and no engineer, he did not think it was very much use sending up the plans alone, and as I was good at model making, would I please make a model of the trailer and submit it together with the plans and blueprints so that when the then Director had it on his desk the idea might penetrate, and we should stand a better chance of getting it approved for production.

In order to show details, a 2 inch to the foot model was decided on and, as we hoped, it was to go to the "Seats of the Mighty," it was decided to build it of polished teak and to electro-plate all metal parts. Our workshop, which was organised for the repair of heavy lorries on the L. of C., had no plating plant, but this difficulty was quickly solved by an old Sikh tin and coppersmith whose civil trade had been that of silversmith. Gian Singh very soon rigged up a small battery silver

plating outfit and, with the help of some of my hard-earned silver rupees, plated all the metal parts, including the frame, as they were manufactured. The model was completed in about three weeks and, as can be seen from the photographs, has four sets of bins, two facing outwards and two facing inwards, on both sides of the body, with an alleyway between bins, a desk for the babu (storekeeper) and a rack for his ledgers and bin cards, two large lockers fitted with racks and containing model springs, are slung on each side of the chassis amidships. A screw-down wheel brake as well as an air-operated brake from the towing vehicle are included in the design. Steering is on the Akerman principle and is operated by the tow bar; a folding ladder is provided aft and eight sliding glass windows provide ventilation in the coach roof—very essential in a hot climate.

The model was duly completed, packed up in a specially made case and dispatched to District H.Q. and a very nice letter of appreciation received with the intimation, "we are now sending it on to Command," and in due course another very nice letter of congratulations and "we are sending it on to G.Q.H. Simla." A curt letter from G.H.Q., "WE DON'T LIKE TRAILERS." So eventually it came back and, as nobody seemed to want it, home it came and was duly attached to a 2-in. scale steam wagon which is known as "Puffing Billy." — W.L.A.F.

* A 15-c.c. FOUR-CYLINDER ENGINE

By Edgar T. Westbury

THE direct attachment of the distributor unit to the timing case, and its direct drive from the end of the camshaft, has the merit of mechanical simplicity, and will be found suitable for most engines used for general purposes, but there are instances when a modification of the method of mounting and driving the distributor may be found desirable, or even necessary. For marine

may be, and often is, quite an extraneous unit to the engine, and driven by gearing or belt from the propeller shaft or some other convenient rotating part, it is obviously much better, in respect of compactness, efficiency, and reliability, to make it an integral part of the engine unit. This can be done fairly neatly, when gearing is fitted for driving a vertical distributor, by driving

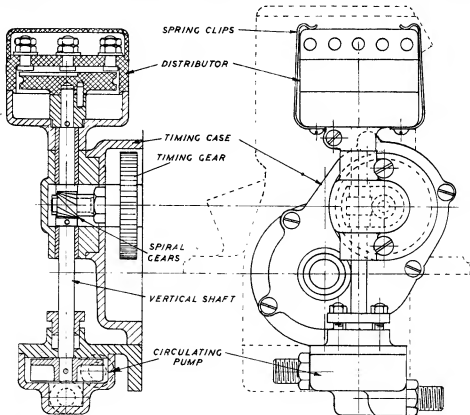


Fig 42. Arrangement of vertical shaft distributor and water circulating pump

work, it is an advantage to have the distributor mounted vertically, providing much better visibility and accessibility when attention to the connections or contact-breaker adjustments are required; and as such engines often call for some method of forced water circulation through the cooling system, provision must then be made for driving a circulating pump. While the latter

the pump from the lower end of the vertical shaft, thereby ensuring the location of the pump in the best possible position, and rendering it accessible, yet unobtrusive.

Vertical Shaft Drive Gearing (Fig. 42)

In arranging the drive for the vertical shaft which drives the distributor and circulating pump, the choice lies between the use of spiral (or "skew") and bevel gearing, either of which must be of very small dimensions, owing to the

*Continued from page 35, "M.E." July 10, 1947.

very restricted amount of space allowable, or at any rate desirable, for housing them in a neat casing attached to the timing case of the engine. Spiral gears have been selected as being most suitable, and also most likely to be obtainable in the size required. There are, or were, stock spiral gears of a suitable type available, but they are not beyond the resources of the model workshop to produce; they should be made in mild steel, and case-hardened. The same applies if the constructor decides to use bevel gears. Stock gears of the latter type, in brass, are obtainable in sizes down to $\frac{1}{8}$ in. diameter, but appear to be a little on the delicate side for this job, and the layout of the gears, which calls for modification of the shaft position, is not quite so convenient.

In order to simplify construction and economise space, the orthodox arrangement of fitting a coupling to the bottom end of the shaft to drive a separate pump shaft, is dispensed with, the shaft being run right through the pump gland, and having the impeller attached to the end of it. The use of a flanged gland with two studs has been decided upon as preferable to a screw gland in this instance, as the latter, if made of adequate size and depth, would take up more vertical space than can readily be spared, in view of the close proximity of the gland to the main engine shaft. In any case, it has been necessary to reduce the bearing length of the pump to the smallest permissible limit, and it would be quite inadequate if a separate pump shaft were fitted.

Modification of Distributor Unit

The only part of the distributor which requires any alteration for fitting to the vertical shaft is the contact-breaker casing, which must, in this case, be adapted to clamp on the extended bush of the gear housing, instead of being spigoted to fit the recess of the timing case. Details of the modified casing are shown in Fig. 43; it may still be machined from the solid without much difficulty, the split lug being left about $\frac{1}{8}$ in. diameter when turning, and afterwards milled or filed to the shape shown. The sawcut may be made with a small circular slitting saw in the lathe, as far as permissible without cutting across the other side of the boss, and finished by using an Eclipse "4S" or Enox hand-slotting saw—or even the crude expedient of a broken hacksaw blade held in a hand vice.

The contact block is fixed in the casing as before, with a nut on the outside, and the rocker pivot may also with advantage be fitted with a lock nut outside, as the thickness of metal into which it is screwed is hardly sufficient to ensure a really adequate hold. It will be seen that the contact-breaker cam is somewhat shortened, and its boss rests in a recess in the modified casing. If desired, the cam may be pinned through the flats, so long as the pin is secure, and is finished flush with the surface both sides. The lower face of the boss acts as a thrust bearing, to take the end thrust of the driving gears, and it is an advantage to interpose a thin fibre or bakelite washer between the surfaces, though the load they encounter under normal working conditions is not at all heavy.

As will be seen from the assembly drawing (Fig. 42), spring clips are used to hold the dis-

tributor to the contact-breaker casing. These are made from 24-gauge spring steel or phosphor-bronze, bent as shown in the detail drawing (Fig. 43), and each secured to the underside of the casing by a 6-B.A. screw.

Skew Gear Housing

This is also shown in the same figure, and may be made either from a casting, or machined from the solid, the internal recess being formed quite easily by end milling, especially when a small milling spindle for use on the cross-slide or vertical slide is available. The most important point in the machining of the housing is the setting out of the centre of the bush seatings, relative to the main centre, to ensure correct gear meshing. It may be found necessary to modify this distance slightly to suit the particular gears available, and in any case it is worth while to make a temporary test jig to verify the correct gear centre distance. It is, of course, possible to allow for gear mesh adjustment by such expedients as eccentric bushes, or even by reducing the spigot diameter of the housing and slotting-out the screw holes so that the housing may be moved sideways on the face of the timing case; but it is better still to avoid the necessity for such adjustments if possible. I have described methods of setting up worm and skew gear housings for machining in connection with the construction of previous engines.

Pump Bracket

The two main components of the pump are best made of gunmetal, unless an aluminium alloy of known water-resisting properties is available. As shown in Fig. 44, the top cover of the pump is formed in the shape of an angle-bracket, which is used as the means of mounting the pump on the end face of the engine sump. This part may be made from a casting, fabricated or machined from solid, and the only point about its machining which calls for any comment is that the under face which forms the joint surface may present a slight difficulty, as it cannot be face-turned right across to the corners without cutting the fillet of the vertical flange in the centre. There is, however, no objection to doing this, so long as a liberal fillet is left each side, to provide proper support. Alternatively, an end mill may be used to face the corners on this flange, and slight undercutting below the circular rim surface will do no harm. The centre hole, spigot and gland counter-bore must, of course, all be true with each other.

The gland should fit the counterbore closely, and its centre hole should be concentric, and a smooth running fit on the vertical shaft. Drilling of the stud holes in the gland and cover may be done in one shot, by clamping the parts together with a bolt through the centre hole.

Pump Body

This also may be constructed in various optional ways, being simply a square box with a lug underneath to take the inlet nipple. Face the top edge and bore the centre to a snap fit on the spigot of the pump cover, also bore the entry port and round off the corner of the hole to reduce the resistance to the water flow. Three of the side corners of the body are rounded off for

perfect fit in a No. 60 drilled hole. It is permissible to taper the end of the pin very slightly to assist entry, but unless the hole is definitely broached out taper, and a pin made to exactly the same angle of taper, it is best to rely on a substantially parallel fit. Pins should never be fitted so tightly that they cannot be removed in emer-

tion, and mechanical reliability. I mention this point because I am always receiving letters from readers, pointing out that certain details in my engine designs are not in accordance with the best possible prototype practice, and often suggesting improvements which, while sound in themselves, would complicate design or introduce



An example of the "Seal" engine camshaft, produced by Mr. N. A. Leach, of Beckenham, Kent

gency, but should be tight enough to prevent the risk of inadvertent movement, which at best will mar one's reputation for reliability, and at worst may wreck the entire works.

It may perhaps be objected, by students of good engine design, that the circulating pump for this engine is by no means an efficient one. The answer is that it is not intended to be. Heaving water at the maximum rate or pressure is not the function of a cooling water circulating pump on a tiny engine; all that is required is to keep a small amount of water moving gently through the jacket. It is a positive disadvantage to circulate the water too efficiently, as an over-cooled engine never runs happily. All that is aimed at in the design is simplicity in construc-

tion, and mechanical reliability. I mention this point because I am always receiving letters from readers, pointing out that certain details in my engine designs are not in accordance with the best possible prototype practice, and often suggesting improvements which, while sound in themselves, would complicate design or introduce

formidable problems in construction. I once ran foul of a Government department expert—who, incidentally, had never built or designed an engine in his life—over the aerodynamical efficiency of a cooling fan on an engine, though the latter was doing its designed job quite efficiently to all intents and purposes, and not absorbing any measurable amount of power in doing so.

I am definitely not a subscriber to the utilitarian doctrine that anything which does its job is necessarily good enough, but when the choice is between a very simple device which does its job, and a much more complicated one which may or may not do it one per cent. better—the answer is obvious.

(To be continued)

For the Bookshelf

Horological Hints and Helps. By F. W. Britten. The Technical Press Ltd. 12s. net. (4th Edition.)

Ever since the 'eighties of last century, the name of Britten has been highly esteemed in the horological world, and the famous "Handbook" of F. J. Britten is almost a watch and clock repairer's household word. Now we have Mr. F. W. Britten's instructive volume, packed with technical information for workers who are already fairly expert at their trade; a very mixed grill, arranged on no discoverable system, and b'dly in need of adjustment from the point of view of English, nevertheless a very present help in time of trouble with obstinate mechanisms.

To support our criticisms first: the last five pages deal with "Gearing—Correcting Bad Depths"; "Poising a Screw Balance"; "Oiling a Watch" (previously described at the beginning of the book); and "Assembling a French Striking Clock." Three pages on "Fitting a Gathering Pallet," follow the section on "Perpetual Calendar" work. This does not matter much, since the Contents and Index pages are good; but the actual writing is more noticeable. A quotation or two may be given. "There are times when accidents will happen to an overcoil which would save great inconvenience if the operator was capable of bending a bent Breguet spring to its normal shape." How do accidents save inconvenience? Of course, the reader

understands; but what a pity! Again, on the same page: "When only he has gained sufficient experience to know the number of different variations in timekeeping are attributed to the balance and spring does he realise what a great deal he has to learn?" There are dozens of sentences in the book that need recasting—two or three of them, indeed, exactly reverse the meaning the author intended to convey.

As to the value of the author's expert descriptions there is no doubt whatever. The reviewer was particularly pleased to see various pages on out-of-the-way watches and clocks—the specimens that are encountered very rarely and can worry even an experienced repairer. Some excellent tips are given; for instance, on the action of the 400-day clock and on its possible faults; on cuckoo clocks and their tricks; and the ordinary, everyday jobs receive full attention. The chief interest, however, to readers will lie in the admirable advice on the right use of the lathe in turning pinions, fitting cylinders, barrels, and other work; and in the detailed instructions relating to various watch and clock escapements; the treatment of hairsprings; conversions, chimes, turret clocks, and the making of a regulator.

In a future edition some of the blocks should be scrapped and new ones made. Figs. 107 and 109 are very rough, with lettering almost illegible; Figs. 127 and 128 are also poor.—W. L. R.

*Railway Interlocking Frames

by O. S. NOCK, B.Sc., M.I.Mech.E., M.I.R.S.E.

No. 12—The Sykes Electro-Mechanical Frame—I

WHEN electricity was first used for the operation of railway signals, examination of some highly-concentrated layouts showed that the most economical solution lay in a combination of electric and mechanical working. The points lying fairly close to the signal box could be worked by rodding, thus obviating the need for expensive electric motors and their associated control gear. The signals, on the other hand, particularly those of the banner type used inside large stations, lent themselves readily to electric operation. To meet such conditions the Sykes electro-mechanical frame was designed. It is a very interesting piece of apparatus, for, quite apart from the combination of mechanical and electrical working, it includes a method of actuating the locking that is quite different from anything so far described in this series of articles.

Fig. 1 shows a cross-sectional view of the apparatus. The full-sized levers are of conventional type, and have a stroke of 2 ft. 6 in.; above them are mounted the slide-levers for electric operation of the signals. The slides have a stroke of only 2 in. The interlocking between point levers is accomplished in the large locking tray at the back of the frame, while the interlocking between signal slides is done in miniature trays housed in the case wherein the slides themselves work. There is necessarily a certain amount of

locking, too, between signals and points, and this is done through vertical rocking-shafts connected to tappets in both points and signals locking-trays. In this first article, I am dealing with the mechanical portion of the frame, leaving the signal slides and the electrical equipment for the second instalment.

The general layout of the frame itself, and of the point levers is distinctly reminiscent of the Stevens apparatus described in THE MODEL ENGINEER for March 7th and 14th, 1946. There is the same method of mounting the uprights, the same kind of trellis pattern in the uprights themselves, and the same relatively short stroke of the levers. But, whereas the Stevens apparatus used direct lever locking, with consequently long stroke on the tappets, the Sykes used a rack-and-pinion gear which provides a stroke of only 2 in. on the tappets.

The rack-and-pinion gear is illustrated in Fig. 2. When the lever is in the normal position, as shown in Fig. 1, the pinion is engaged with a projection on the bridge piece, *E*; due to this engagement, the pinion cannot turn when the lever is moved, and since the teeth of the pinion are engaged with the rack, the rack and pinion move as one solid piece until the lever has been moved sufficiently far for the pinion to come out of engagement with the projection on *E*. During the time that the pinion is engaged with *E*, the rack, and the tappet which is con-

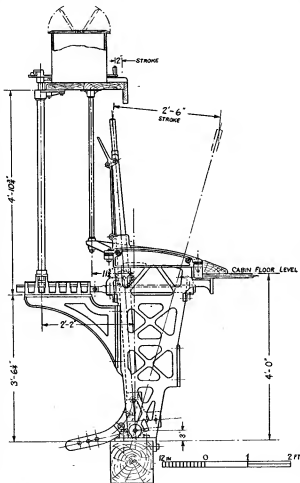


Fig. 1

*Continued from Vol. 96, page 532, April 24, 1947.

connected to it, is moved 1 in., bringing the assembly into the position shown in the lower view in Fig. 2. As soon as the pinion passes out of engagement with *E* it begins to turn, and no further movement is imparted to the rack until the lever approaches the end of its stroke. Then the second notch in the pinion engages with the corresponding projection *F*, which prevents any further turning. For the last portion of the lever stroke, pinion and rack again move as one, and a further 1-in. travel is imparted to the locking-tappet.

To ensure that no movement whatever of the tappet takes place between the initial 1 in. and the final 1 in., there is a fixed rack mounted

The teeth of the pinion are $1\frac{1}{2}$ in. wide, thus covering the two $\frac{1}{2}$ -in. wide racks. The pinion is carried on a member which slides on the lever, since it could not follow the radial motion of the lever. This sliding saddle *A* has a roller *B* which engages the underside of the fixed rack, and prevents the pinion riding up out of engagement with the teeth on the two racks.

The particular frame illustrated in Fig. 1 is that installed in Victoria North Box, L.B. & S.C.R.; in this the point levers were spread $5\frac{1}{2}$ in. apart, and the signal slides $2\frac{1}{2}$ in. apart. The spacing of the signal slides was, within certain limits, varied to suit the particular layout.

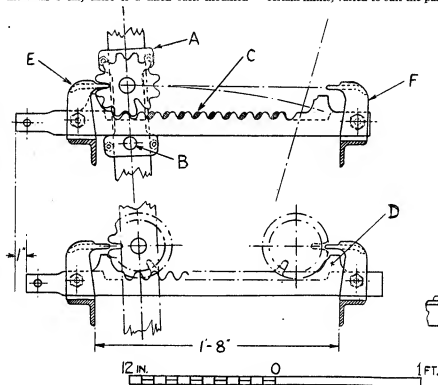


Fig. 2.

alongside the rack portion of the tappet. When the lever is in the fully normal position, as shown in the upper view in Fig. 2, the teeth of this fixed rack are out of line with the teeth of the tappet. The fixed teeth are shown cross-hatched at *C*. The first movement of the lever, pinion and tappet brings the teeth of the latter into line with the fixed teeth, and thus the rotation of the pinion is properly regulated. It will be seen that there are only nine teeth on the fixed rack. At the end of its travel the pinion comes into contact with the lug *D* forged on the tappet, and with the projection on bridge piece *F* engaging in the slot in the pinion the tappet is driven a further 1 in. to the right.

The pinion has twelve teeth, on a pitch-circle diameter of 5 in. The total travel of the pinion centre is 15 in., during 13 in. of which it is rolling.

If a case occurred where the number of signal slides was more than double the number of point levers, the spacing of the signal slides was reduced. In the extensive installation of the Sykes electro-mechanical system at Glasgow, St. Enoch, and in the outlying signal-boxes in the approach to that terminus, the signal slides were pitched only 2 in. apart. Clyde Junction box, for example, had 70 signal slides mounted above 30 point levers, making a very compact mechanism only 12 ft. 8½ in. long. The frame for Victoria North, shown in Fig. 1, was not a large one, having 21 point levers and 76 signal slides, and did not include a great deal of locking. The adjoining frame in the South Box was no less than 44 ft. long, this including 106 mechanical levers and 163 electrical slides.

(To be continued)

*WATCHING THE WHEELS GO ROUND

No. 3—The Stroboscope

by H.C.W.

THE third and last method to be described of "Watching the wheels go round" is the stroboscope. An impressive name for a very simple device.

Suppose a wheel to be rotating 100 times a second and that we look at it through a shutter which opens for a very brief instant every 1/100th of a second (exactly the same speed as the wheel). Every time the shutter opens we shall have a glimpse of the wheel, but it will be in the same position each time, and so it appears to us to be stationary, even though it is rotating at 6,000 r.p.m. It will also be fairly obvious that the wheel will appear stationary if the shutter speed is either 50, 33 $\frac{1}{3}$, 25, etc., times per sec.

What happens if the shutter speed is faster than 100 times a second? Well, that depends on the shape of the wheel. If it has two spokes and is in every way symmetrical and the shutter speed is 200 per second, the wheel would still appear stationary at 6,000 r.p.m. So also if the wheel had four spokes and the shutter speed was 400 per second, but in both these cases we are getting more than one glimpse of the wheel per revolution; in fact, one per spoke. That is why the spokes appear stationary.

It will be fairly clear that if, instead of a shutter we have flashes of light of very short duration, in an otherwise darkened room, the wheel will appear stationary for a flash speed of 100 per second in the same way. Supposing we decrease the flash speed to 99 per second. The wheel now appears to be rotating in the normal way but at a speed of 1 r.p.s. If the flash speed is increased to 101 per second the wheel will then appear to be rotating backwards at a speed of 1 r.p.s. It is a fairly common thing to see this stroboscopic effect illustrated at the cinema by a cart moving across the screen with its wheels revolving backwards or not moving at all. Or a man appears to be swinging an aeroplane propeller which then proceeds to run in reverse. These are all caused by

the intermittent nature of the light on the screen.

The main use of the stroboscope, then, is for apparently slowing down the speed of moving parts, which are nevertheless still working at high speed, to enable the movement to be followed closely.

Take, for example, the valve bounce on an I.C. engine. It is possible to set the stroboscope so that the valve appears to go through its motions of lift and drop quite slowly, even though working at high speed, and any bounce as a result of weak valve springs is at once apparent. In this way the stroboscope can be applied to slow down, for examination, any movement which is being repeated at regular intervals at a speed which is not much lower than the persistence

of vision. It will not, of course, slow down one isolated movement such as the fall of a hammer or the breaking of a glass.

Construction

It might be thought that such a device would be complicated and fairly costly to make, but in fact it is not so. Most of the components can be found in the average workshop junk box.

They should be connected up as shown in Fig. 13. It will first be necessary to remove the cap on the neon lamp and take out the ballast

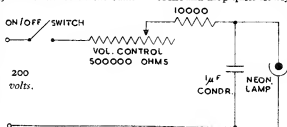


Fig. 13

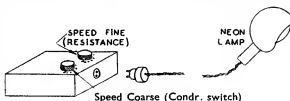


Fig. 14

circuit shown will flash the neon at the rate of approximately 2 per second at minimum and about 100 per second at maximum. Higher speeds can be obtained by using a condenser of smaller capacity and it may be as well to have three condensers of 1, 0.1 and 0.01 microfarads and a range switch to select whichever is required. The condensers should be rated to stand a higher voltage than that of the battery or they will eventually break down.

It would be best to assemble the various parts on a box containing the battery, with an extension

*Continued from page 41, "M.E.," July 10, 1947.

lead for the lamp. A power pack, operated from the mains, can be used in place of the battery if desired, but the current required is only of the order of 10 ma. or less. The operation of the device is quite simple. The neon lamp passes no current until a certain voltage is reached. Above that voltage it becomes conducting and its resistance is very low. The condenser is being charged all the time from the battery through the variable resistance and, since it is connected across the neon, when its voltage reaches the critical value, the neon lamp becomes conducting, discharges the condenser and extinguishes. The condenser charges up again and the cycle is

repeated. This process will no doubt be recognised by readers as our old friend the saw-tooth wave used as the time base for the cathode-ray oscillograph.

The lamp thus gives a series of flashes at a speed determined by the value of the resistance and the capacity of the condenser. It will be advisable to try the neon in either direction to see which gives the brighter light value. If the neon is used as the only source of illumination, it will be quite easy to follow the working of the most complicated link motion at high speed, provided that its speed can be held constant.

Editor's Correspondence

Model Speed Boat Hull Design

DEAR SIR,—As a regular reader of Mr. E. T. Westbury's articles, I was more than interested when in a review he gave, called "Future Plans," a writer, Mr. T. Brooks mentioned the curious reluctance of engineers to house their efficient engines in equally efficient hulls.

This readiness to exhibit first-class workmanship, in what are little more than modified cigar boxes, I myself deplore, and I feel that if just a little of the attention to design expended on engine development were used in the hull design, increased performance would at once amply repay the builder.

Another aspect that I feel is interesting, is that even where hulls have been designed with thought and care, they still would be ruled out as boats. Endeavour to run a modern racing hydroplane on a straight course! The ratio of beam to power output is absurd.

A few enthusiasts in this area have been working on the free-running steerable hydroplane, and timing has been carried out over a straight course. The fact that these builders can control their models is in itself an advance, and some interesting hull designs have shown that even on a limited power of 2-c.c. speeds up to 20 m.p.h. are possible.

I would mention before closing that I am designing a radio-controlled $\frac{1}{16}$ in. to 1 ft. scale Fairmile M.T.B. in which I hope to instal a 15-c.c. "Seal" engine.

This will give a maximum speed of approximately 22 knots, and I intend its first prolonged trial to be from Southampton to Cowes. After this it may be run from Dover to Calais.

Yours faithfully,

Brockenhurst.

H. A. ADAM.

Fuels for C.I. Engines

DEAR SIR,—We were most interested to read of the use of ether in C.I. engines in the article "Petrol or Diesel?" in your issue of June 12th.

In this article the author mentions that further information on the various grades of ether would be welcome. As important manufacturers of this chemical we have pleasure in passing to you the following data:—

There are four important and recognised grades of ether, viz.,

- (a) Ether Technical. British Standards Specification No. 579 (B.S.S.).
- (b) Ether. British Pharmacopoeia (B.P.).
- (c) Ether Anaesthetic. British Pharmacopoeia (B.P.).
- (d) Ether Analytical Reagent. (A.R.).

All four grades are almost entirely free from acidity; a and b have practically the same specification but differ essentially from c and d in that they contain aldehyde and that the wider range of specific gravity permits the presence of more water and alcohol, and they are not suitable for anaesthetic or analytical purposes.

The following table shows the principal differences:—

Grade	Specific Gravity 15.5°	Boiling Range	Aldehyde	Non-volatile Residue
B.S.S.	0.720-0.725	95% below 36°	No test included. Contains appreciable trace.	Not more than 0.005%.
B.P.	0.720-0.724	All between 34° and 36°.	ditto	Not more than 0.002%.
Anaesthetic.	0.720	All between 34° and 35°.	No reaction.	Not more than 0.002%.
A.R.	0.720-0.722	95% between 34° and 35°.	No reaction.	Not more than 0.001%.

Yours faithfully,
MAY & BAKER, LTD.
Dagenham.

Model Gas Turbines

DEAR SIR,—Having read the letter published in THE MODEL ENGINEER by Mr. Varley on model gas turbines, and his reference to the torpedo engine, I decided to write a few lines about it. The engine is a four-cylinder rotary; the cylinders are of hard brass, the pistons of cast-iron. The heating takes place in a brass casting from which the hot gases pass to a steel induction ring, which feeds the cylinders. Each cylinder has an inlet-valve which is operated by a cam. The fuel used is shale oil or paraffin.

The heat generated by the heater would be sufficient to burn up the heater if it is allowed to burn out of the water. Re the U.S.N. torpedoes, they were, as far as I can remember, driven by unheated compressed air.

Yours faithfully,
J. L. COTTON.
Iver.